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A TRUNK DISEASE OF THE LILAC

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A general discussion of diseases of the common lilac (*Syringa vulgaris* L.) was recently published by Klebahn (3). This author enumerates a number of diseases, such as the one of bacterial origin ascribed to *Pseudomonas Syringæ,* various leaf diseases due to species of *Microsphæra, Glœosporium,* and other leaf parasites, and a disease due to *Botrytis cinerea.* The major part of the work, however, deals with a disease due to *Heterosporium Syringæ* Oud., affecting the leaves, and a serious twig blight due to *Phytophthora Syringæ* Klebahn. Subsequent papers by various writers deal with one or the other of the diseases mentioned by Klebahn.

During recent years a destructive trunk disease of the common lilac (*Syringa vulgaris* L.) has been noted a number of times in the Missouri Botanical Garden, and in grounds in the vicinity of St. Louis. The affected plants were usually old bushes which had been more or less neglected, and the tops of the leading trunks were frequently dead. Long shoots from the root and others from the part of the trunks near the ground made a dense tangle around the main stem; on the latter sporophores of *Polyporus versicolor* were found in various stages of development, sometimes isolated, but more frequently in groups. Sections were made of the trunks on which this fungus was growing and it was found that such trunks were invariably diseased, while those close by, either from the same root system or from adjacent bushes—which were free from the fungus—were always sound.

In pl. 8 fig. 1 two affected trunks are shown cut at points about three feet from the ground. In both cases the larger part of the stem was alive, as evidenced by the presence of vigorous shoots along the entire length. Pl. 8 fig. 2, and pl. 9 figs. 1, 2 represent sections of lilac trunks taken from different bushes to show different stages of the disease.

The wood of the lilac is white in color, hard, and close-grained. In younger trunks there is no appreciable difference between heart-wood and sap-wood; as the trunks grow older, however, the heart-wood turns darker, and in those twelve years old, or thereabouts, it is distinctly darker than the rather thin, white sap-wood.

The disease first manifests itself in the inner heart-wood, frequently in close proximity to the holes made by the lilac borer. This lepidopterous insect (*Podosesia syringœ* Harris) (for whose identification I am indebted to Dr. E. P. Felt) has been found very destructive to lilac bushes, and, according to Beutenmüller (1), occurs from New England and the middle states westward to Colorado and southwest to Texas. Quoting from Beutenmüller's account: "The female deposits her eggs in patches on roughened or knotty places on the bark of ash and lilac. The eggs, according to Hulst, hatch in about six days, and the newly born larvæ at once eat their way through the bark into the solid wood. They run their channels longitudinally for about 8–10 inches through the wood. The larvæ pupate in slight cocoons after cutting their way to the bark, of which they leave only a thin outer skin. The pupation usually takes place early in May, and the moths emerge in about three weeks." Felt (2) briefly described the habits of the larva, stating that "a sign of its presence in midsummer being largely the sudden wilting of a shoot." He quotes from an observation made by Dr. Kellicott in which the latter states that he "watched 20 or more issue from a single tree in one day, and found that often there were more than one hundred in one tree." Felt recommends cutting and burning all infested wood in the early spring.

In the vicinity of St. Louis the lilac borer has been very active in recent years, judging from the fact that very few lilac bushes over five years old were found free from its attacks. Without much doubt the fungous spores get into the interior of the lilac trunks through the borer holes, and start to develop within the heart-wood on the edges of the borer holes. In pl. 9 fig. 1 two borer holes, still filled with pieces of the borings, can be seen in the lower right-hand trunk, and one small hole in this same section occurs in the sap-wood. The fungus, after it has begun to grow in the hole, rapidly spreads up and down in the heartwood, and soon grows out from the center toward the bark. As the disease progresses, the wood is converted into a soft, pithy, white mass, having the consistency of corn-stalk pith. The line of demarcation between the sound and completely destroyed wood is very sharp (see pl. 9), resembling in this respect the type of decay caused by this same fungus in living catalpa trees ((5), pl. 26). The line between sound and decayed wood is so sharp that entirely decayed fibers adjoin perfectly sound ones. Between the wholly unaffected wood and the completely destroyed fibers, is a narrow ring of darker wood, which is, to all intents and purposes, sound; the wood cells are partially invaded by the mycelium of the fungus, and the lumina are filled with a yellow-brown liquid, which when seen in mass gives the section the dark color referred to. This liquid dries out in some places and leaves a brown amorphous substance, such as has frequently been found in the early stages of decomposition of hardwood wood fibers (6). It probably consists of decomposition products which are infiltrated into the sound wood immediately in advance of the fungus. In cases where the fungus starts in several centers, rings of the darker colored wood surround each decayed portion, a condition which is well shown in pl. 9 figs. 1, 2, where the fungus is growing in the center of the trunk and in addition in three more peripheral localities. In the lilac the brown substance referred to is ultimately destroyed (see the middle trunk of the lower tier, pl. 9 fig. 2, where the wood is destroyed up to the bark).

The completely decayed wood, which readily absorbs water, resembles pith, and in general is very similar to catalpa wood destroyed by *Polyporus versicolor* (5). It has some of the attributes of wood, i.e., it can be split, is fairly compact, and cannot be crumbled into powder. Sound lilac wood is very heavy and hard, and is composed almost wholly of very thick-walled wood cells, with small vessels scattered with considerable regularity throughout the annual ring; wood parenchyma is almost wholly absent. The hyphæ of *Polyporus versicolor* attack and very rapidly destroy the layers of secondary thickening of the wood cells. The middle lamellæ retain the nature of lignified fibers and resist destruction almost entirely, although here and there some of them are dissolved, giving rise to small separated cell groups. Entire dissolution rarely takes place (this was also found to be true for diseased catalpa wood ((5) pl. 52)). With the removal of the secondary thickening, the resulting decayed wood has a skeletonized appearance. It has all of the elements, but these are very thin-walled. The fine medullary-ray cells are destroyed here and there, producing radial, isolated masses, but more frequently the decayed mass hangs together firmly. The dissolution of the layers of secondary thickening goes forward very evenly, bringing about the sharp dividing line between sound and decayed wood already referred to.

The only difference between the catalpa and lilac diseases is that in the catalpa the entire wood mass is skeletonized, whereas in the lilac hard areas of undestroyed wood fibers are left here and there, surrounded by decayed wood (pl. 9 figs. 1, 2). These masses are either entire rings (pl. 9 fig. 1) or irregular areas lying detached within the decayed parts, and represent portions of the heart-wood which for some reason have temporarily escaped total destruction; the wood fibers are filled with the yellow-brown substance, but do not otherwise differ from normal wood fibers. As the disease progresses, however, they are finally destroyed. This was made evident by the fact that in the upper parts of diseased trunks these immune areas were always found coexistent with the early stages of the disease, while lower down in the trunks, where the advanced stages of decay had been reached, they were practically absent. The temporary immunity may be due to the presence of more resistant groups of wood fibers, possibly also to a high concentration of decomposition products.

The development of the fungous mycelium from the center of the trunk out toward the bark differs radically from that of any other disease known to the writer. In most trees the destruction of wood by a fungus growing in the dead heart-wood is confined to the latter,—further growth ceasing as soon as the mycelium reaches the sap ring. As has been suggested by Münch (4), this is probably due to the fact that most mycelia of wood-destroying fungi require a balance between the amounts of oxygen and water contained in the wood fiber. Any undue percentages of either may make the conditions unfavorable for further development.

In the lilac disease the fungus may grow outward concentrically in a regular manner (pl. 9 fig. 1). Very frequently, however, the fungus grows out into the sap ring at one side, at first slowly, then more rapidly. This is well shown in pl. 9 fig. 2, where four successive stages are represented by photographs. In the upper left-hand trunk the fungus has almost reached the bark, and in the three lower ones it has reached the bark and is gradually killing it. The probable explanation for this behavior is to be sought in the water content of the wood fibers. It was found that in many cases where the fungus actually grew up to the bark and through it, that on that side the lilac borer had been active; the wood fibers in the vicinity of the holes dried sufficiently to make growth possible for the mycelium, and as the destruction took place more drying occurred in adjacent areas until ultimately the whole sap region on that side was invaded and destroyed.

A number of water determinations were made of the wood fiber in the immediate vicinity of the growing mycelium, and the results compared with those obtained from normal sap-wood. In all cases the sap-wood about to be invaded was found to have a very much lower water content than the normal sap-wood. Unfortunately, it was impossible to get exact data which would indicate accurately the highest moisture content at which growth was possible; infected wood had obviously already reached and gone beyond that point, and as to sound new wood, even that which was near the borer holes, nothing could be postulated with certainty concerning its susceptibility or non-susceptibility to fungous attack. It would be an interesting problem to test the water susceptibility of *Polyporus versicolor* in its relation to lilac wood. It seems probable, however, that the drying out of one side of the trunks was at least one of the determining factors in the rather striking and exceptional method of growth of the fungus. Whether the fungus would eventually have destroyed the entire trunk it is impossible to state, because no such wholly destroyed trunks were found. There seems to be no reason, however, why this should not occur; in fact, the right-hand trunk of the lower tier in pl. 9 fig. 2 has very little live wood left.

After the mycelium has reached the bark it grows through it, and fruiting bodies develop on the outside. The latter sometimes occur singly, but more commonly in linear groups parallel to the long axis of the trunk. Frequently one or more fruiting bodies grow out from the holes made by the borer. In the right-hand trunk in pl. 8 fig. 1 sporophores are shown growing out at the base of vigorous, live shoots; in the left-hand trunk the shoot is dead, having been killed during the year as the fungus invaded the wood from which the shoot was growing.

The sporophores found were typical of *Polyporus versicolor* L. This fungus is so common on the dead wood of various hardwoods that a detailed description is hardly necessary. It is interesting to note here that this is the second instance where this fungus attacks living plants. In the case of the catalpa the fungus grows vigorously only in the live tree; infected wood rarely, if ever, is decayed after it is cut from the tree. Many thousand posts of catalpa, the heart of which had been partially destroyed by *Polyporus versicolor*, have served as fence posts during the last ten years without showing a sign of decay of that part of the wood which was sound at the time of cutting. With the lilac it is different; the dead wood is just as subject to attack as is dead oak, beech, or gum wood.

The age at which lilac bushes are attacked has not been definitely determined. Those examined were about 15–20 years old (2½ inches in diameter). The trunk shown in pl. 8 fig. 2 was over thirty years old. It is probable that the disease is not serious until the bushes are ten or more years old, although this will depend somewhat on the rate of growth. Trunks 1½–2 inches in diameter were frequently found diseased. The effect of the disease is to gradually kill the top of the trunk; side shoots then develop farther down, which in turn are killed by the fungus, and eventually the trunk is broken off by the wind or snow.

The prevention of the disease is possible by continued attention to the borers. A careful examination for the latter should be made in June or July, and if any are present these should be killed by means of a wire, and the holes—after antiseptic treatment with some coal-tar compound—plugged. Painting or brushing the lower parts of trunks with whale oil soap, or its equivalent, should also prove of value. Wherever a diseased trunk is found it should at once be cut out and burned. All dead wood in the neighborhood of lilac bushes should be cleaned up, so that the chances for infection may be reduced.

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[For other insects attacking lilac see Rep. N. Y. State Mus. 59^4: 839. 1905.]
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Explanation of Plate

PLATE 8

Trunk disease of lilac due to *Polyporus versicolor*

Fig. 1. View of two diseased lilac trunks showing the sporophores of *Polyporus versicolor*, and the manner in which living branches grow from diseased trunks.

Fig. 2. Sections of an old diseased lilac trunk showing the decayed heart-wood.

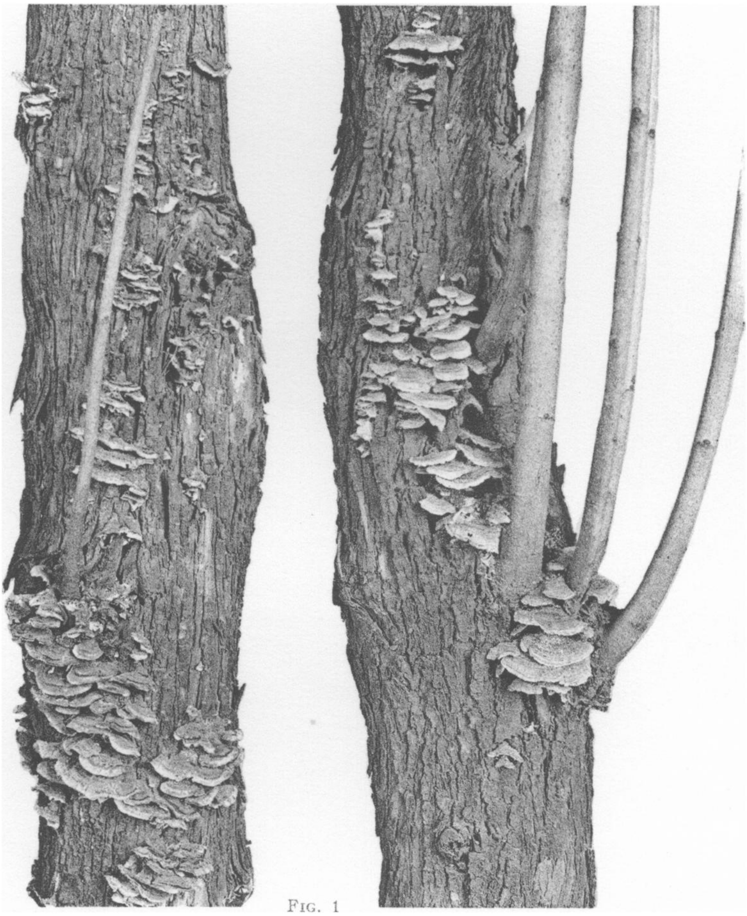

FIG. 1

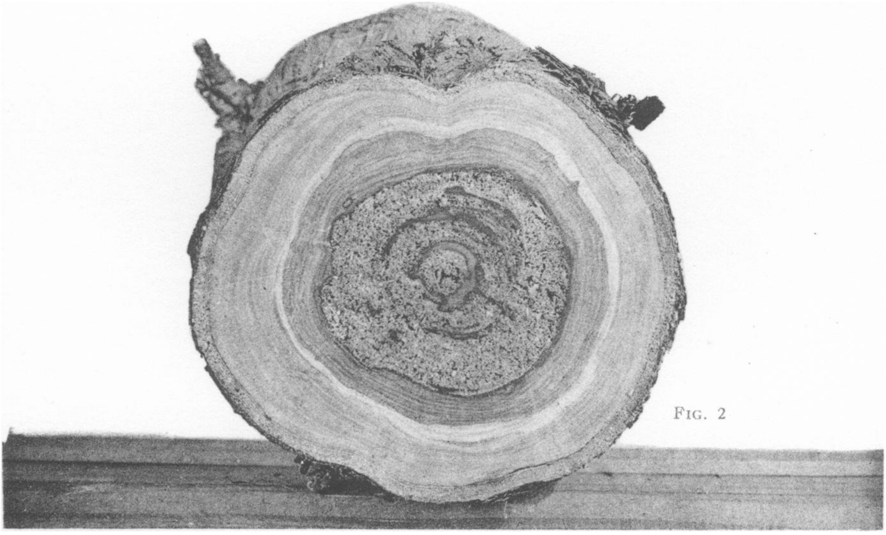

FIG. 2

VON SCHRENK — TRUNK DISEASE OF LILAC

COCKAYNE, BOSTON.

Explanation of Plate

PLATE 9

Trunk disease of the lilac due to *Polyporus versicolor*

Fig. 1. Sections of three diseased trunks showing early stages of the disease.

Fig. 2. Sections showing progressive stages of the lilac trunk disease.

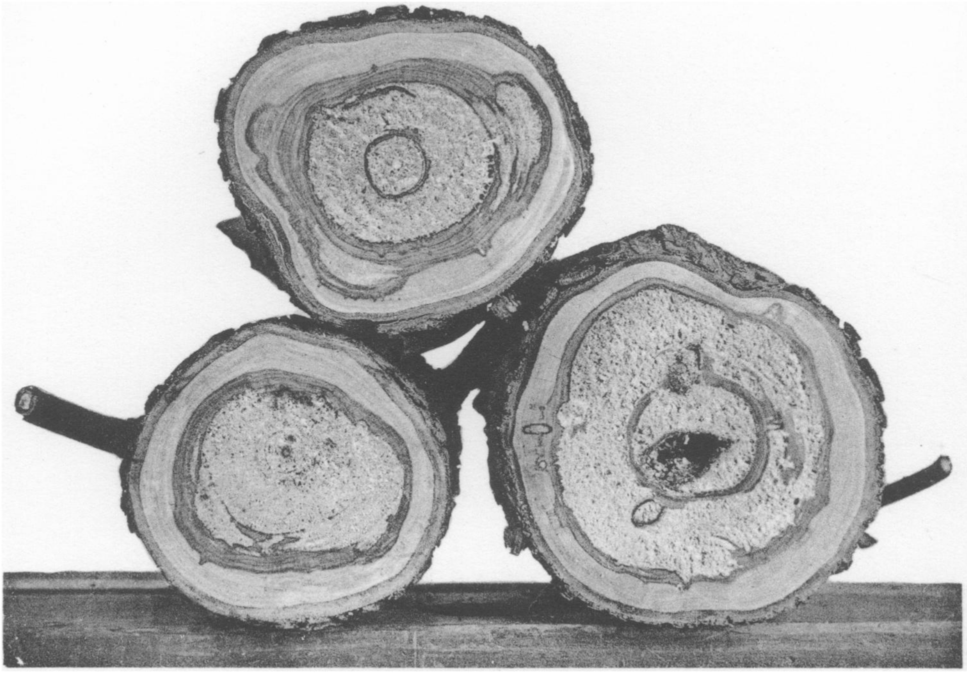

FIG. 1.

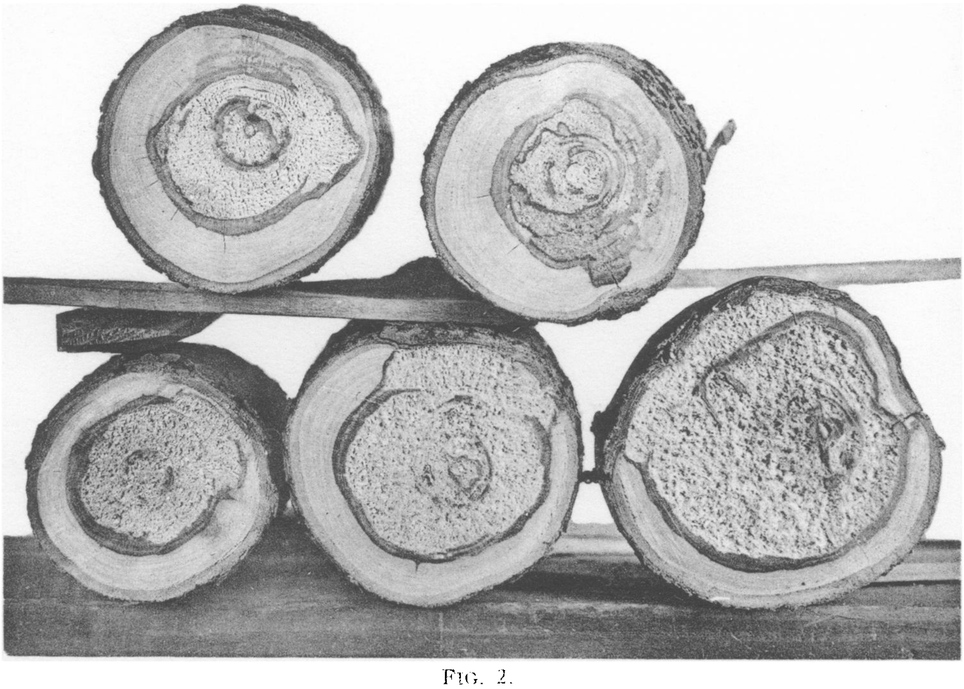

FIG. 2.

VON SCHRENK—TRUNK DISEASE OF LILAC

COCKAYNE, BOSTON.